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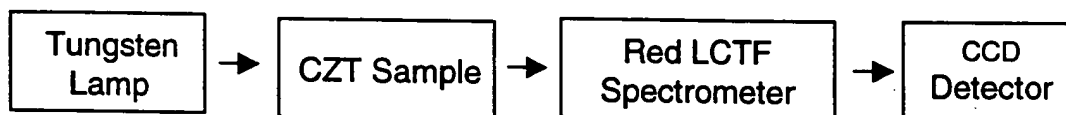
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EXHIBIT

A

Project Title: Chemical Imaging for Semiconductor  
Metrology  
Project No.: 98ATP01  
Date: April 6, 1999

**CHISM**  
**CZT NIR Transmittance Imaging Test Configuration**  
**Block Diagram**

**Sample**

- CZT etched and unetched

**Source**

- Tungsten lamp

**Dispersive Spectrometer**

- Entrance slit = 100  $\mu\text{m}$
- Spectrometer = 0.5 m
- Grating = 1200 gr/mm

**CCD Detector**

- Thermoelectrically cooled to  $-40^{\circ}\text{C}$
- 512 x 512 pixels
- Pixel size = ~~9  $\mu\text{m}$~~   $24 \mu\text{m} \times 24 \mu\text{m}$
- CCD exposure = 3 seconds

**Comments**

- Date: March 19, 1999
- Red Falcon Microscope

**Microscope Configuration**

- Objective: 20X
- N.A.: 0.46

**LCTF Scanning Parameters**

- 830 – 900 nm
- Step size: 5 nm



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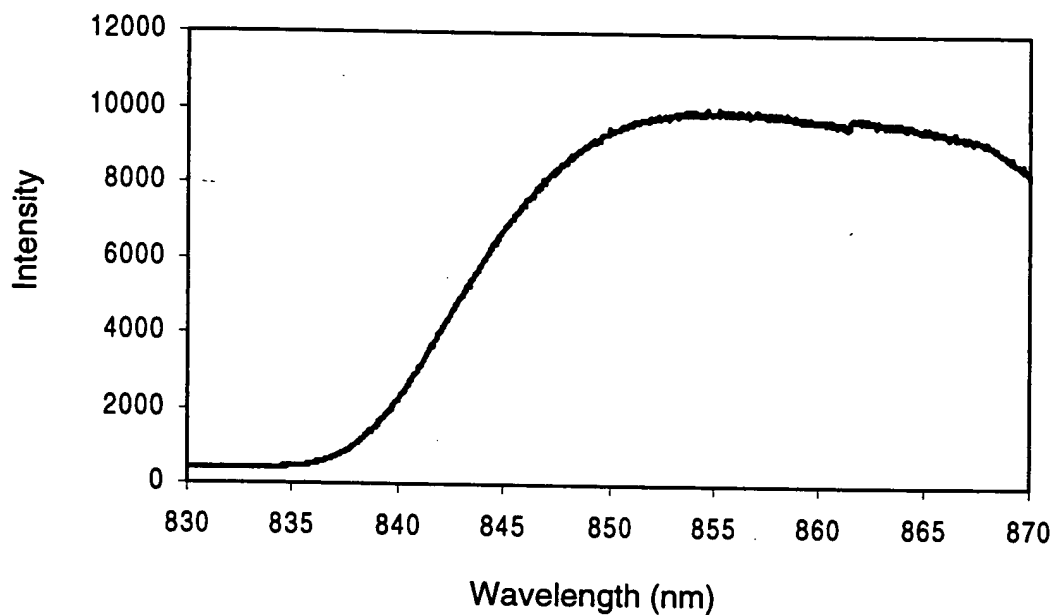
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### CHISM CZT NIR Transmission Spectroscopy



Comments In order to determine the



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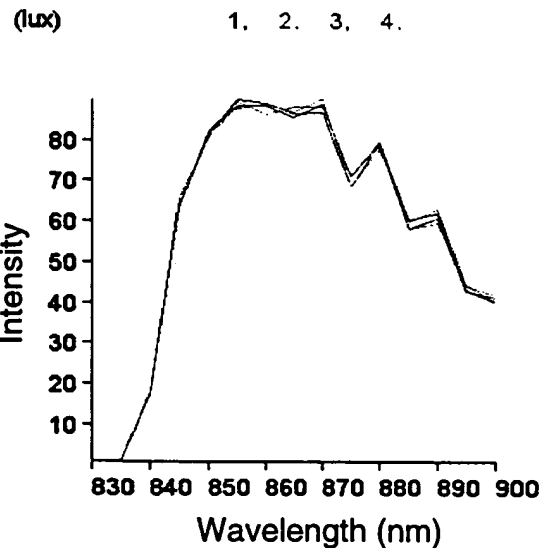
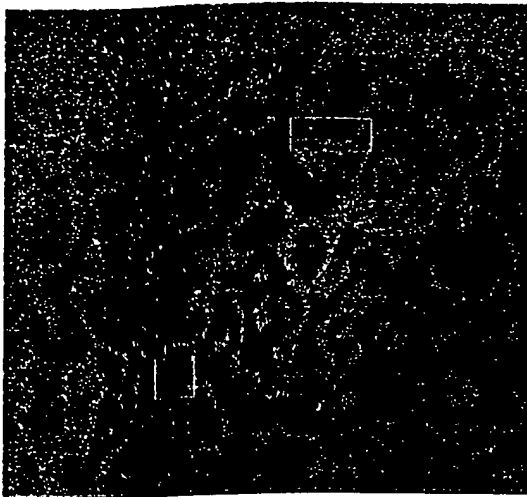
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Project No.: 98ATP01  
Date: April 6, 1999

## CHISM

### Typical NIR LCTF Microspectra of Unetched CZT



**Spatial Results** Little contrast is visible in the NIR image except for an inherent instrumental response

**Spectral Results:** There is little variation in spectral profiles taken at locations 1-4.

**Location:** Quadrant 0,3

**File Name:** D:\ATP\990322\_JMR\_027 \_\_CZT\_allcos.tif

**Data:** Cosine Correlated

**Wavelength:** 880 nm

**Comments** We may address the instrumental response issue seen in these NIR images by Fourier transform analysis



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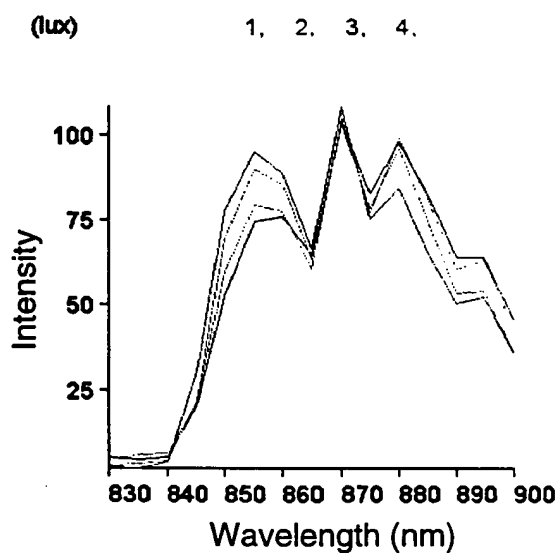
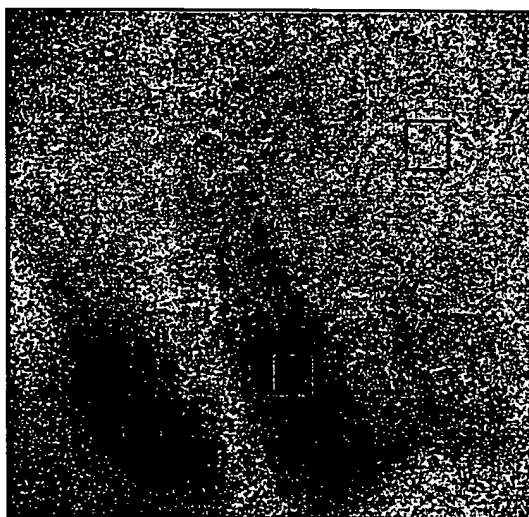
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Project No.: 98ATP01  
Date: April 6, 1999

## CHISM

### NIR LCTF Microspectra of Etched CZT (Defect Type 1)



**Spatial Results:** Spatial contrast can be seen in relatively large regions.

**Spectral Results:** Spectral variations are evident at locations 1-4.

**Location:** Quadrant 0,4

**File Name:** D:\ATP\990322\_JMR\_005 \_\_CZT\_allcos.tif

**Data:** Cosine Correlated

**Wavelength:** 855 nm



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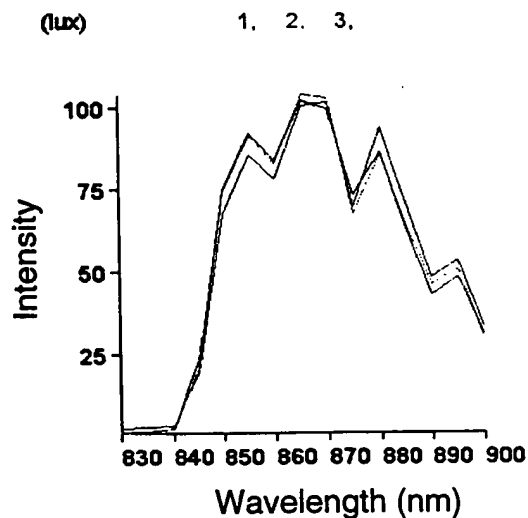
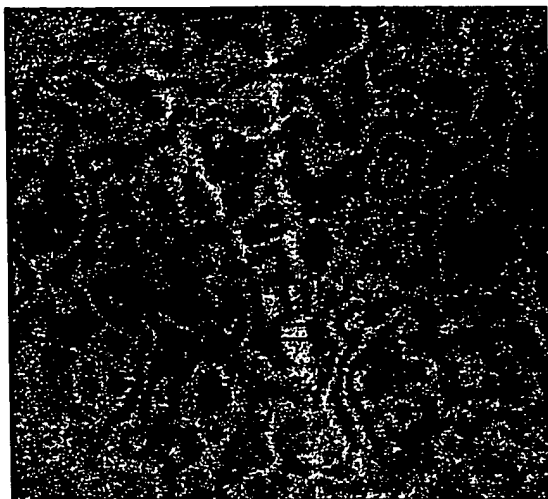
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Project No.: 98ATP01  
Date: April 6, 1999

**CHISM**  
**NIR LCTF Microspectra of Etched CZT (Defect Type 2)**



**Spatial Results:** Spatial contrast can be seen here at the junction of two fine scratches.

**Spectral Results:** Spectral variations are evident at locations 1-4.

**Location:** Quadrant 0,3

**File Name:** D:\ATP\990322\_JMR\_004\_CZT\_allcos.tif

**Data:** Cosine Correlated

**Wavelength:** 880 nm



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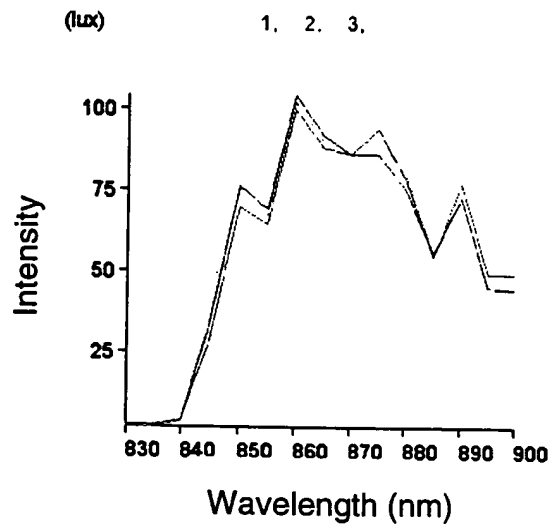
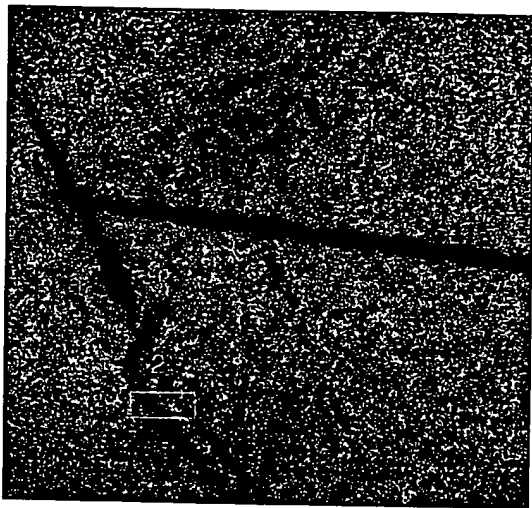
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Project No.: 98ATP01  
Date: April 6, 1999

## CHISM

### NIR LCTF Microspectra of Etched CZT (Defect Type 2)



**Spatial Appearance:** Spatial contrast is evident here at the junction of three fine scratches.

**Spectral Results:** Spectral variations are evident at locations 1-4.

**Location:** Quadrant 3,0

**File Name:** D:\ATP\990322\_JMR\_016 \_\_CZT\_allcos.tif

**Data:** Cosine Correlated

**Wavelength:** 850 nm

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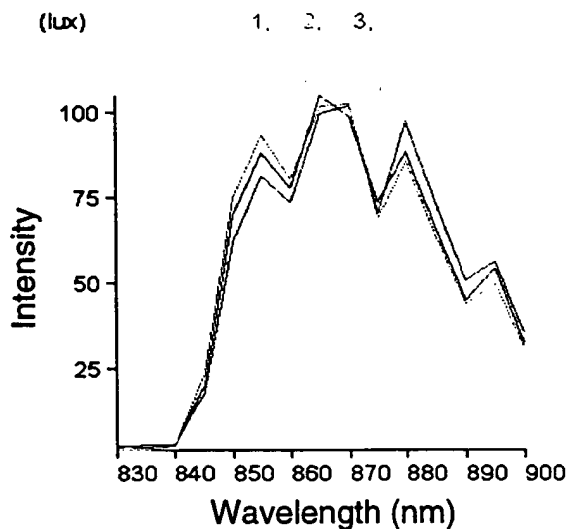
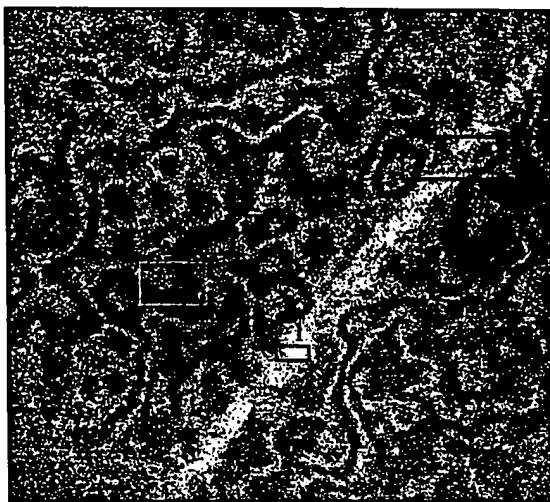
Date

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Project Title: Chemical Imaging for Semiconductor Metrology  
Project No.: 98ATP01  
Date: April 6, 1999

**CHISM**  
**NIR LCTF Microspectra of Etched CZT (Defect Type 3)**



**Spatial Results:** Spatial contrast can be seen here over a prominent surface scratch.

**Results:** Spectral variations are evident at locations 1-4.

**Location:** Quadrant 0,2

**File Name:** D:\ATP\990322\_JMR\_003 \_\_CZT\_allcos.tif

**Data:** Cosine Correlated

**Wavelength:** 880 nm



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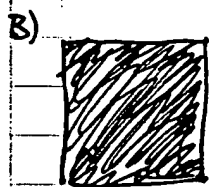
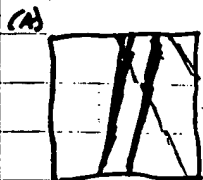
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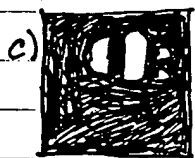
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62. IMAGE OF TWO SCRATCHES THAT APPEAR DARK <sup>TO</sup> AND RUN PARALLEL, AND ARE ONLY FAINTLY VISIBLE. <sup>SIGNIFICANTLY</sup> THE SCRATCHES <sup>(A)</sup> DO NOT APPEAR DARKER UNDER THE U-AN AND U-OP FILTERS, BUT THEY DISAPPEAR ENTIRELY WHEN BOTH FILTERS ARE IN PLACE (B).



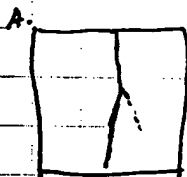
990415-JMR-062-C2T.tif (R)  
990415-JMR-062-C2T-allows.tif (C)

THE SCRATCHES WERE CLEARLY VISIBLE <sup>USING</sup> WITH PHOTO LUMINESCENCE. (C)

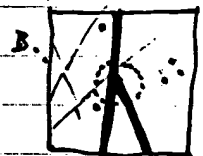


A THIRD SCRATCH ALSO SEEMS TO BE VISIBLE, INTERSECTING THE RIGHT PARALLEL SCRATCH. (R)

63. IMAGE OF TWO SCRATCHES CONVERGING, ~~DIVERGING~~.



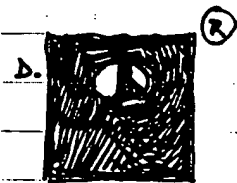
A. IS THE VIEW FROM THE VIDEO MONITOR. ONE SCRATCH IS VIRTUALLY VISIBLE, ALTHOUGH FAINT, AND THE OTHER BRANCHES OFF AT A 45° ANGLE AND FADES AWAY.



B. UNDER ~~THE~~ THE U-AN FILTER AND THE U-OP FILTERS SEPARATELY. THE SCRATCHES APPEAR DARKER AND MORE DEFINED. THE SIDE SCRATCH DOES NOT APPEAR TO FADE AWAY. OTHER SCRATCHES AND DEFECTS APPEAR.



C. WITH BOTH U-OP AND U-AN FILTERS IN PLACE, ONLY THE SIDE SCRATCH IS VISIBLE.



D. THE RAW DATA SET SHOWS THE JUNCTURE OF THE TWO SCRATCHES. <sup>(DRAWN AT 840nm)</sup> A <sup>(R)</sup> THIRD SCRATCH APPEARS BETWEEN THE OTHER TWO CREATING A SEEMINGLY HORIZONTAL BAR IN A CAPITAL "A". THIS THIRD SCRATCH ~~WAS~~ WAS NOT VISIBLE PRIOR.

990415-JMR-063-C2T.tif (R)  
990415-JMR-063-C2T-allows.tif (C)

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